DOI: 10.53246ANMS0026 MUSEOLOGIA SCIENTIFICA nuova serie • 16: 86-98 • 2022 ISSN 1123-265X

The theft of naturalistic specimens in museum contexts. A modern phenomenon with historical roots

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ABSTRACT
The work aims to turn the spotlight on the vulnerability of naturalistic museum collections to thievery. This topic is under-represented in museological and legal discourses, despite the awareness of the importance of building up security measures to counter illicit misconduct. To reach this goal, the historical roots of the phenomenon are investigated by analyzing the thefts that occurred at the Florentine Imperial and Royal Museum of Physics and Natural History between the 18th and 19th centuries. Particular attention is paid to the stolen minerals by reconstructing the forensic investigations and their collecting history to the present day. The study of these criminal cases revealed a gradual implementation of protection means such as cataloging the specimens. In conclusion, this work proves the importance to maintain attention on the vulnerability factors of museum naturalistic collections, stressing the use of proper methods and practices useful to their mitigation.

Key words:
naturalistic specimens, museum collections, theft, security measure, cataloging.

RIASSUNTO
Il furto di esemplari naturalistici in contesti museali. Un fenomeno moderno con radici storiche

Il lavoro analizza la vulnerabilità delle collezioni museali naturalistiche ai furti. La tematica è scarsamente dibattuta negli studi museologici e giuridici, nonostante la consapevolezza dell'importanza di implementare misure di sicurezza per contrastare i comportamenti illeciti. Per raggiungere questo obiettivo, si indagano le radici storiche del fenomeno analizzando i furti avvenuti presso l'Imperiale e Reale Museo di Fisica e Storia Naturale tra il XVIII e il XIX secolo. Particolare attenzione viene data ai campioni rubati ricostruendo le indagini forensi e la storia collezionistica dei campioni recuperati fino ai giorni nostri. Lo studio di questi casi criminali ha evidenziato una graduale implementazione di misure di protezione, tra cui una corretta catalogazione delle collezioni. In conclusione, questo lavoro vuole portare all'attenzione della comunità degli studiosi i fattori di vulnerabilità cui possono essere soggette le collezioni dei musei naturalistici, evidenziando metodi e pratiche adeguate alla loro mitigazione.

Parole chiave:
campioni naturalistici, collezioni museali, furto, misure di sicurezza, catalogazione.

INTRODUCTION

A growing body of literature recognizes the importance of studying crime against cultural properties (e.g., Kila & Balcells, 2015). These analyses mainly focus on the theft and illegal trafficking of artworks and archeological heritage (e.g., Hufnagel & Chappell, 2019; Mackenzie et al., 2019) also in the context of contemporary armed conflicts (e.g., Frulli, 2011; Sironi De Gregorio, 2021). However, such approaches leave the illicit acts committed against naturalistic heritage in the dark figure of unreported crime, especially the thievery involving naturalistic collections preserved in university museums. In this regard, it is worth mentioning that such losses go far beyond their financial value (e.g., Bradley et al., 2014). The specimens comprising them can be considered "time capsules of science" (Lourenço & Sousa Dias, 2017), which play a pivotal role in society and research by contributing with their unique and unreproducible insights to the growth of scientific knowledge and cultural awareness (e.g., Krishtalka & Humphrey, 2000; Suarez & Tsutsui, 2004; Harmon et al., 2019; Miller et al., 2020; Franza & Pratesi, 2021a).

Despite their relevant material and intangible meanings, the vulnerability of naturalistic collections is still extremely high. As an example, table 1 illustrates the theft of 11 rhino horns that occurred in 5 Italian university natural history museums between 2011 and 2015. To these episodes, it has to be added the robbery of two rhino horns preserved at the Civic Natural History Museum of Macerata on 29 July 2014 (see website 1) and the stealing of another specimen, which later proved to be a polystyrene replica, at the Civic Natural History Museum "Giacomo Doria" of Genova on 7 August 2015 (see website 2). On this subject, Pennock (2017) pointed out that since 2009 rhino horns have been stolen from museum collections in several countries such as South Africa, Ireland, Germany, England, Austria, and the Netherlands. Grove & Thomas (2016) then stated that the thefts targeting rhino horns were a real international concern in the 2000s for wildlife crime prevention in museum environments (see also Dorfman, 2018). The authors, quoting a report issued by the European Police Office (see website 3), underlined that the powder of rhino horns was particularly sought after on the black market due to its use in Traditional Asian Medicine (Viscardi, 2012; Ellis, 2013). To prevent and counter the spread of these illegal acts, natural history museum managements were recommended to remove the specimens from the display and keep them in the warehouses (see website 4). An exhaustive examination of these robberies is out of scope here. However, the aforementioned episodes highlighted the urgency to reduce the vulnerability factors affecting museum naturalistic collections as well as the need to find effective methodologies for their examination and assessment.

A good starting point for more in-depth studies is represented by the investigation of the historical attitudes towards thieving of museum naturalistic specimens, which can reveal how to relate to the past from the perspective of future interventions more than an investigation into the history of criminal behavior. The analysis was based on this conceptual framework since the society we are living in today is tied to the legacy of its past. For instance, Higgins (2019) outlined how Western society's long history of collecting was in part forged in the 18th century when museums were established and opened to the public. The first natural history public museum in Europe was the Imperial and Royal Museum of Physics and Natural History, founded in 1775 in Firenze by order of the Grand Duke of Tuscany Peter Leopold of Habsburg-Lorraine (1742-1790) (e.g., Contardi, 2002). Following the cultural milieu of Enlightenment, the scientific and naturalistic museum collections (Barsanti & Chelazzi, 2009: 19-23; Contardi, 2009; Raffaelli, 2009; Monechi & Rook, 2010; Pratesi, 2012) – although continuing to belong to Peter Leopold, who was a collector himself (Franza et al., 2022b) – were accessible "all day, from morning to evening, in the same way as the public libraries" (see Archive 1) and were organized to encourage the process of a visitor's self-instruction. Every specimen on display was cataloged and accompanied by a tag indicating its use thus allowing visitors to be informed of its theoretical and technical value (Contardi, 2000). Commenting on the museum setting and its attendance, the naturalist and museum's first director Felice Fontana (1730-1805) (Contardi, 2006) reported to Peter Leopold that the Imperial and Royal Museum of Physics and Natural History was more visited than

Date	Museum	Nos. of stolen rhino horns
9 July 2011	Natural History Museum - University of Firenze	3
22 January 2015	Zoology and Comparative Anatomy Museum - University of Modena and Reggio Emilia	1
9 March 2015	Natural History Museum - University of Pisa	1
2 June 2015	Zoology Museum -University of Bologna	1
10 September 2015	Zoological Museum - University of Napoli "Federico II"	5

Tab. 1. The thefts of rhino horns occurred in Italian natural history museums between 2011 and 2015.

the Uffizi Gallery (see Archive 2), as confirmed by the examination of the attendance records (Mazzolini, 2006; Fontanelli, 2019). These data showed that the museum was very popular since its foundation and therefore its collections were subjected to diverse vulnerability factors such as damage and theft. On those grounds, the Florentine Imperial and Royal Museum of Physics and Natural History was chosen as an exemplary case study to illustrate the topic of this work, i.e., the vulnerability factors of museum naturalistic collections and their assessment through time.

This article has thus been organized in the following way: it begins by showing the procedure used and the materials analyzed. What happened to a part of the stolen specimens will then be examined in detail, and their collecting history, reconstructed through the inventory data reported in the archival documents, will also be investigated. The rest of the paper proceeds by discussing the findings in the light of the research questions characterizing the work, and briefly summarizes the effects of mitigation interventions on the safeguard of the collected specimens. Finally, these measures will be examined given the advances made in this line of research in recent years.

MATERIALS AND METHODS

This paper used a case-study approach to gain both qualitative and quantitative insights into the theft and illicit acts committed at the Imperial and Royal Museum of Physics and Natural History in Firenze from its foundation in 1775 to 1868. This period was documented by the museum management and administration records preserved within the Archive of the Royal Museum of Physics and Natural History of Firenze at the Galileo Museum. The fund comprises about 5700 records, covering the first century of museum activity, and represents one of the most relevant primary sources to investigate its history (see website 5). As already stated, the collecting history of the specimens involved in the illicit events was investigated when the archival documents reported their inventory data. In this regard, it is worth mentioning that the official documents recorded only the inventory numbers of the minerals, and therefore the scientific biography of these specimens (e.g., Daston, 2000) was reconstructed by analyzing the catalogs and inventories kept in the Firenze State Archive and the Historical Archive of the Firenze University Museum System. These primary sources have been described in Cipriani et al. (2011). In particular, this article examined the museum inventory compiled in 1790 and the catalogs drawn up in 1820 and 1844. The deaccessioning registers made in 1821 and 1842 were also analyzed (fig. 1). The investigation of documents and textual materials has been performed following the standard archival research methods detailed in Ventresca & Mohr (2017).

Case Study

The first record describing a theft that occurred at the Imperial and Royal Museum of Physics and Natural History dated back to 25 December 1789 when the Royal General Administrator, Luigi Bartolini Baldelli (1745-1800), asked Felice Fontana to fil a formal complaint to the Florentine Supreme Court of Justice about the thievery of a coral specimen that was on display in the Lithophytes Room (see Archive 3). From this moment on, such illicit acts were related to museum management and local authorities on a more regular basis, and therefore a comprehensive framework can be provided. In this regard, figure 2 illustrates the rate of theft and damage from 1792 to 1868 according to the reports contained in the administrative documents. The graph shows that about 1045 illicit acts were registered during this time. The number of crimes reached a peak in 1792-1793 (158 cases) and 1859-1860 (160 cases), while the rate fell to a low point in 1850 (47 cases) and between 1864 and 1868 (39 cases). Below are listed some criminal events that were selected for their historical relevance and scientific importance.

Crime #1

The first criminal event was about the potential damage of some naturalistic specimens and the theft of some carved corals as detailed in the report the museum custodian Luigi Gagli (†1795) wrote between 4 and 6 March 1793. On 4 March, Gagli noted that the foot guard Valenzani (dates uncertain) had rebuked

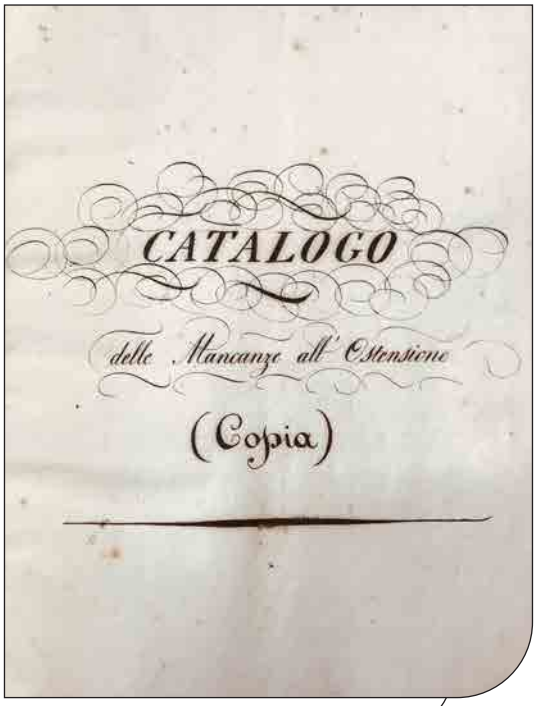

Fig. 1. Frontispiece of the deaccessioning register (1821-1842) (photo courtesy Firenze University Museum System).

a foreign visitor who grabbed a jar in the Sea Worms Room. The day after, Gagli caught another guard in the act of opening a jar filled with spirit and preserving some shipworms. On 6 march the report accounted for the questioning of Pietro Bruschi (dates uncertain), who worked at the museum as a gemstone engraver, about the theft of some coral specimens. The interrogation was conducted by the naturalist and museum's vice director Giovanni Fabbroni (1752-1822) (Pasta, 1989), in the presence of Gagli and the botanical garden's superintendent Attilio Zuccagni (1754-1807). Bruschi was suspected to have bought some corals equipped with silver supports that were very similar to the stolen ones. He firmly denied the allegations and no further information was given on the loot recovery (see Archive 4).

Crime #2

On 14 May 1799, the naturalist Giuseppe Raddi (1770-1829) (Parrini, 2010; Baldini & Pignotti, 2018), who worked at the Imperial and Royal Museum of Physics and Natural History as a custodian and a taxidermist, reported to Fontana the theft of 8 rare shells occurred during the museum opening hours. The specimens were in the cabinets nos. 5-8 and 10, and among them there was a specimen of *Bulla ovum* (Linnaeus, 1758), a *Buccinum maculatum* (Linnaeus, 1758), a *Turbo cochlus* (Gmelin, 1791), and a *Conus striatus* (Linnaeus, 1758). The thief was identified by the museum employee Giacinto Guidetti (dates uncertain), who surprised him while grabbing another shell from the cabinet n. 7. Commenting on the episode, Raddi complained about the lack of surveillance personnel, demanding Fontana hire new staff as soon as possible. The day after the robbery, Raddi checked the integrity of the other naturalistic collections on display. So, he discovered that an iron mica (lamellar hematite) specimen with iridescent hematite from Rio dell'Elba was also stolen, together with three poor-quality specimens of fluorite. Informed of the theft on 16 May 1799, Fontana asked Zuccagni to list the 12 specimens in the museum's deaccessioning register including their economic estimate (9 lire for the shells and 3 coins for the minerals) (see Archive 5).

Crime #3

About three months later (on 19 August 1799), Raddi reported to the Superintendent of the Royal Estates Alessandro Galilei (dates uncertain) a new theft concerning the malacology collection. While doing the patrol, he discovered that six shells on display, among them two specimens of *Buccinum Harpa* (Linnaeus, 1758), were stolen during the museum opening hours. Therefore, Raddi demanded an improvement in the surveillance service and the placement of glass protections in the cabinets where the specimens were exhibited. Furthermore, he suggested removing the most valuable ones from the display and storing them

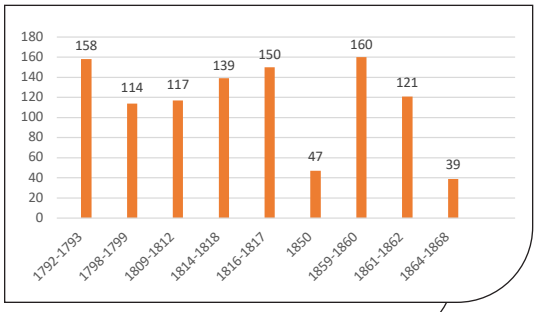

Fig. 2. Rate of illicit acts (mainly theft and damage) committed at the Imperial and Royal Museum of Physics and Natural History between the 18th and 19th centuries.

in a safer environment. However, the Royal Estates Superintendence did not agree. On 26 August 1799, Superintendent Claudio Segardi (dates uncertain) replied that non-routine expenses were planned for the museum. In absence of protective glasses and more surveillance guards, Segardi advised Raddi to store the finest specimens in a locked room (See Archive 6).

Crime #4

One of the most relevant crime events occurred at the Imperial and Royal Museum of Physics and Natural History on 29 July 1818. That day the employee Luigi Baci (dates uncertain) was tidying up the rooms of the former Chemistry Laboratory that had been temporarily assigned to Giuseppe Raddi's son Ferdinando (dates uncertain), who ended his work as a taxidermist on 25 July. While doing his job, Baci discovered a key abandoned between the remains of some moth-eaten birds. In the meantime, the naturalist and museum Director Girolamo Bardi (1777-1829) (Vadalà, 2017) found that the lock of the glass storage room had been broken. Around 2 pm, the smith Gaetano Simonetti (dates uncertain) arrived at the museum and confirmed that the lock had been forced with a pick, while the glass storage door was opened with the key Baci recovered in the old rooms of the Chemistry Laboratory. Inside the warehouse, various minerals were found, among them 8 jasper pieces, a black stone with a tag showing its inventory number, and an iron ore from Elba Island. During the same day, Ferdinando Raddi confessed to having stolen several specimens from the museum collections such as two birds that were later been sold to the Count Bonturlin (dates uncertain), diverse glass bells whose exact number he could not remember (maybe 4 or 5), 7 glass jar he sold after having taken them from the warehouse, 3 small bottles of different dye colors he found in the Chemistry Laboratory, 8 carved jasper specimens, 9 crystals kept in the storage room, and 3 pieces of gres. Raddi then confessed to having forced the lock of the glass storage room. On 3 August was established a commission formed by Bardi, the custodian Giovanni Bettoni (dates uncertain), the Minister

Specimens found	Numbers of specimens
bell glass containing	5
American birds	56
quadrupeds	7
herons and a rotten one	4
American birds in a poor conservative status	18
birds from Gaiana in a case	30
birds from S. Vitale in a case	30
birds in in a half-bell	12
birds in a large bell	27
nutcracker in a bell	1
parrot	1
woodcocks	2
snipes	2
hens	2
owls	2
little herons	2
marsh herons	2
pigeons	2
mallard birds	6
Chinese red heron	1
imperial eagle	3
eagle owl	1
swan	1
gazelle	1
hedgehog	1
herd	1
monkey	1

Tab. 2. The inventory of the specimens found in the old rooms of the Chemistry Cabinet or removed by the museum's permanent exhibition.

Numbers of specimens	Museum inventory numbers
4	5320
	5326
	5327
	5332
3	5315
	5317
	5321
2	5316
	5319
3	5306
	5198
	5200
1	5199
1	5310
1	5344
1	5293
1	5135
1	5072
1	5283
1	5303
1	522 (Boemia)
1	987 (Idem)
3	7333

Tab. 3. Inventory of the mineralogical specimens that were found scattered on the floor. 5 September 1818.

Antonio Guasconi (dates uncertain), and the witnesses Giuseppe Lenzi (dates uncertain) and Giovanni Soldi (dates uncertain). Luisa Raddi (dates uncertain) was then summoned in place of her husband and son. Until 6 August this commission met every morning at the museum. Guasconi sealed 5 rooms – where the cataloging of the naturalistic collections was going on – 30 cabinets, 16 boxes, and a cabinet containing cataloged and uncatalogued objects. Subsequently, Bettoni drew up a list of the specimens comprising their inventory number. A similar list, which, however, did not report the specimen inventory numbers, was made for the birds that were found in the old rooms of the Chemistry Laboratory or that were removed by the permanent exhibition (tab. 2). On 5 September the seized rooms were reopened to continue the cataloging activities. On this occasion, various mineralogical specimens, most of them of very poor quality, were discovered scattered on the floor. An inventory of these samples was also compiled as shown in table 3. Ten days later the Grand Duke of Tuscany Ferdinand III of Habsburg-Lorraine (1769-1824) pardoned Ferdinando Raddi, who was then released on the condition that he no longer entered the Imperial and Royal Museum of Physics and Natural History until further notice (see Archive 7).

Crime #5

On 11 January 1867, the Director of the Imperial and Royal Museum of Physics and Natural History Igino Cocchi (1828-1913) (Corsi, 1982) went to the police station of St. Spirito to report the thievery of some gold and platinum specimens, which were on display in the cabinet n. 32 in the Mineralogical Gallery. The forensic investigations revealed that the employee Carlo Bencini (born 1805) noted their absence from the permanent exhibition on Tuesday morning during the opening hours (i.e., from 10 to 13). Silvestro Bercigli (dates uncertain) and Pietro Gamberucci (born 1815), who oversaw the surveillance, stated that they had not noticed any suspicious behavior among the visitors. The complaint was provided by a list showing the museum inventory numbers, the typology, and the weight of the stolen

Inventory Nos.	Specimens	Weight
5350	Native gold	3.10
5351		0.20
13164		6.5.6
13211		2.13
13212		2.6
13214		2.8.20
5355	Platinum nuggets	3.7.15

Tab. 4. Inventory of the minerals stolen in January 1867. The weight of the specimens is expressed in ounces.

specimens (tab. 4). Inspector Carnevale (dates uncertain), in his report n. 224 dated 23 March 1867, described the nature and space-temporal dynamics of the theft. The Christmas holidays were just passed when a police informer stated that theft was about to be committed in the Cerratani district by Gigino Porelli (dates uncertain) and other burglars. The area was immediately set under surveillance and no illicit event occurred. In the meantime, the robbery at the Imperial and Royal Museum of Physics and Natural History was taking place. The first crime reconstructions were directed toward the museum staff since it was taught that the key to the cabinet containing the gold specimens was left unattended on a table. However, after further investigations, this scenario was excluded. The theft would have been organized by the inmate Oreste Masini (dates uncertain), the robber and murderer Francesco Mongivacchi (dates uncertain), Telemaco Materassi (dates uncertain), and Enrico Gentilini (dates uncertain), who was later arrested and thus substituted by Francesco Beccatini also known as the "Becchino". Materassi was in charge of duplicating the museum keys, but the copy resulted to be damaged. Therefore, the crime was postponed and a new strategy to break into the museum was devised. Porelli, who knew diverse foreign languages, pretended to be a museum guide so that Materassi could sneak into the museum rooms unnoticed. When the crime was committed, Beccatini was left behind and thus he revealed to the law enforcement that the gold specimens were bought by the fence Egisto Mannelli (dates uncertain), who held more than 150 stolen gemstones belonging to the Mineralogical Gallery. Finally, Beccatini pointed out that Mannelli had suggested to the partners which were the most valuable specimens kept in the museum cabinets but being inexperienced they were unable to recognize them (see Archive 8).

RESULTS AND DISCUSSIONS

The case studies illustrated in the previous section indicate that some of the vulnerability factors naturalistic collections face today – such as thievery and damage – have always been present. For instance, Case #1 outlined the damage to exhibits resulting from unauthorized tactile behavior, whose investigation is now part of an emerging multi-disciplinary field in museum studies (e.g., Candlin, 2017). Furthermore, Case #1 and Case #2 underline how the urgency of developing a primary physical security program to protect collections from damage and theft was already recognized in the past. Barriers such as display cases, locks, and safes slow down a person from having inappropriate access to a specimen. However, due to the lack of maintenance funding (as often happens today), Raddi's requests to reinforce the surveillance and enclose the more sensitive specimens in a vitrine (Case #3) has to wait until 4 July 1817, when Filippo Nesti's (1780-1849) proposal (Barbagli, 2013) to close the museum cabinets preserving valuable objects with crystals will be approved by the Royal Secretariat for a total cost of 1287 lire (see Archive 9). On the other hand, it will have to await the theft of three carved emeralds occurring on 14 June 1850 for a new guard to oversee the front door of the mineralogical collection (see Archive 10). Whilst the night surveillance service will be implemented on 27 December 1860 together with the installation of a lock to the door connecting Pitti Palace to the Imperial and Royal Museum of Physics and Natural History (see Archive 11).

Case #4 then outlined the issue of internal theft. The specimens, such as those mentioned above, can also be stolen by museum personnel who are usually trusted as internal to the institution. This illicit behavior has been reported in the case of Hendrikus "Hank" Van Leeuwen, who stole more than 2000 objects from the Australian Museum as a temporary assistant conservator in the late 1990s (Prott, 2007). Since a part of the specimens involved in Ferdinando Rabbi's robbery was mentioned in the police records together with the museum inventory numbers (tab. 3), its collecting history has been investigated. A preliminary analysis revealed that 23 inventory numbers referred to the catalog of the mineralogical collections drawn up in 1820, comprising 4 volumes preserved at the Firenze State Archive. When present, these catalogs also reported the numbers of the previous 18th-century inventory, thus allowing to date the entry of specimens in the museum collections. 20 out of 23 were listed in the first volume, which was devoted to the illustration of the specimens kept in the fourth room of the mineralogical exhibition (see Archive 12). Three specimens (Inv. n. 7333) were then listed in the catalog showing the samples kept in Room XV (see Archive 13). Inventory numbers 522 and 987 pertained to the inventory of Room IX compiled in 1797 (see Archive 14) and no further information is available in the 19th-century catalog. The transcription of the catalographic descriptions is reported in table 5. It can be seen from the data

Inv n.	Catalog 1793	Inv. n.	Catalog 1820	Inv. n.	Catalog 1844	Inv. n	Deaccessioning catalog 1821-1842
5356	Sal Gemma granelloso, ricuoperto da due strati di Spato pesante, e fibroso; di Wieliczka in Pollonia	5320	Soda muriata in massa ricoperta dalla Barite solfata crestata in stato di decomposizione, di Wieliczka in Pollonia	–	–	2118	Soda muriata in massa ricoperta dalla Barite solfata cristata in stato in stato di decomposizione di Wieliczka in Pollonia
5428	Sal Gemma squammoso, e cristallino colorito di rosso e sparso di piccoli frammenti di Argilla nerastra di Gmunden nell'Austria superiore	5326	Soda muriata lamellare verde rossastra, semitrasparente; di Gmunden nell'Austria superiore	–	–	2109	Soda muriata lamellare verde rossastra, semitrasparente; di Gmunden nell'Austria superiore
5448	Sal Gemma granelloso, unito ad un'ammasso di Lapilli di Quarzo, collegati dall'Ocra Marziale, dell'Austria	5327	Soda muriata con frantumi arenacei di Quarzo e col Ferro ossidato rosso; dell'Austria	–	–	2108	Soda muriata con frantumi arenacei di Quarxo, e col Ferro ossidato rosso; dell'Austria
5670	Alotrico, ò Sale Vetriolico piumoso, che rifiorisce nelle Gallerie delle Cave di Cinabro d'Idria (vas: 1)	5332	Magnesia sulfata (Alotrico) bianca aderente all'Argilla, delle Cave del Mercurio d'Idria	2626	Magnesia solfata (Alotrico) bianca aderente all'argilla delle cave di mercurio, d'Idria	–	–
–	–	5315	Una custodia vetrata entrovi Calce trovata allo stato caustico in una Polla detta di S. Gonda verso S. Miniato	376	Calce trovata allo stato caustico in una polla detta di S. Gonda verso S. Miniato	–	–
5544	Allume piumoso, mescolato col Vetriolo marziale nativo; della Cava di Roccalumiera tra Taormina e Messina in Sicilia	5317	Alluma solfata alcalina fibrosa (Allume piumoso) mescolata col Ferro solfato, della Cava di Rocca Lumiera fra Taormina e Messina	5165	Allumogeno fibroso, mescolato col ferro solfato, dalla Cava di Rocca Lumiera fra Taormina e Messina	–	–
5543	Allume nativo piumoso; delle antiche Miniere di Zolfo di Capo d'Arso in Sicilia	5321	Allumina solfata alcalina (Allume piumso) con Zolfo cristallino; delle antiche Cave di Zolfo di Capo d'Arso nella Sicilia	5166	Allumogeno fibroso con lo zolfo cristallino, delle antiche Cave di Zolfo di Capo d'Arso nella Sicilia	–	–
6180	Quattro formelle quadrilunghe di Pietra di rovine di due differenti grandezze, che una scantonata e tutte incassate in cornici dorate	5316	Due formelle con cornice dorata a guisa di quadri di Calce carbonata dendritica a dendriti ruiniformi, rosse e brune, di Rimaggio	3581-3582	Calce carbonata dendritica a dendriti ruiniformi rosse e brune, di Rimaggio	–	–
5350	Sal marino delle Moje di Volterra, configurato a foggia di Stalabite dallo Scolo dei Gabbei di quelle Fabbriche	5319	Soda muriata concrezionata bianca, dello Scolo dei Galbei nel Volterrano	–	–	2106	Soda muriata concrezionata bianca dello Scolo dei Galbei nel Volterrano
5981	N° 6 pezzi di Stalagmite Coralloide contrassegnati da N^{i} relativi ai loro respettivi cataloghi	5306	Arragonite fibrosa in riunioni coralloidi di color celeste sopra il Feldspato	2888	Arragonite fibrosa in riunioni coralloidi di color celeste sopra il Feldspato	–	–
4963	Due Pezzi Lustrati di Manganese areato e roseo, disposto a raggi concentrici, come la Zeolite, di Boinik nella Transilvania	5198	Calce carbonata ferro-manganesifera rosea concrezionata col Ferro sulfurato, di Boïnik nella Transilvania	8543	Manganese carbonato (Diallogite) roseo concrezionato col ferro sulfurato, di Boinik nella Transilvania	–	–
171 and 175	Oro nativo nella Miniera d'Argento bianca ricuoperta di Cristalli di Rocca incrostati di Manganese areato e Stalattitico di Nagaya – Miniera d'Argento Aurifera con un ingemmamento di Cristallo di Rocca incrostati di Manganese Areato, e Stalattitico di Nagaya	5200	Calce carbonata manganesifera che riveste il Quarzo ialino con qualche vestigio d'Argento antimoniale e col Ferro sulfurato dodecaedro; di Nagaya	2852 -2851	Arragonite fibrosa sericea bianca nel rame ossidato ferrifero terroso, del Bannato di Temeswar – Arragonite di f. primitiva ed acicolare raggiata semitrasparente sopra il quarzo opaco bruno		

Tab. 5. Catalog descriptions of the mineralogical specimens involved in Ferdinando Raddi's robbery. (continued on p. 93)

Inv n.	Catalog 1793	Inv. n.	Catalog 1820	Inv. n.	Catalog 1844	Inv. n	Deaccessioning catalog 1821-1842
4963	Due pezzi lustrati di Manganese areato e roseo, disposto a raggi concentrici, come la Zeolite, di Boinik nella Transilvania	5199	Calce carbonata ferro-magnesifera rosea concrezionata col Ferr sulfurato; di Boïnik nella Transilvania	8543	Manganese carbonato (Diallogite) roseo concrezionato col ferro sulfurato, di Boinik nella Transilvania	–	–
6175	Una bellissima Stiria conico-spirale, di Stalattite spatosa, della Grotta di Antiparos, che riposa sopra Base di Legno ottagona marmorizzata, e filettata d'oro	5310	Calce carbonata concrezionata stratiforme biancastra; della Grotta di Antiparos. Posa sopra base di legno ottagona tinta e filettata d'oro	8227	Calce concrezionata stalattitica biancastra d'Antiparo	–	–
6816	Combinazione della Magnesia con la Terra calcaria, con l'Argilla, e con la Calce del Ferro, dalla quale resulta una Terra verde, granellosa, e duttile nella quale degenera il Serpentino di Boemia esposto all'Aria (1 vaso)	5344	Magnesite argillifera verde rossastra rotulante dalla decomposizione del Serpentino della Boemia (1 vaso)	–	–	2290	Magnesite argillifera verde rossastra rotulante dalla decomposizione del Serpentino, della Boemia
5981	N° 6 pezzi di Stalagmite Coralloide contrassegnati da N^{i} relativi ai loro respettivi cataloghi	5293	Arragonite? Corallide bianca sulla sua sostanza grigia	2882	Arragonite coralloide bianca sulla sua sostanza grigia	–	–
6798	N° 72 pezzi - ingemm.^{ti} diversi di Spato pesante combinati con diverse sostanze lapidee - metalliche, e contrassegnati da numeri relativi ai loro respettivi cataloghi. N:B: Alcuni de pezzi di questo scaffale sono decomposti e alcuni piccoli	5135	Calce carbonata ferrifera bruna lenticolare colla Barite solfata e col Quarzo ialino prismato sul Rame piritoso di Zellerfeld	3712	Calce carbonata ferrifera bruna lenticolare con la barite solfata e col quarzo ialino prismato sul rame piritoso di Zellerfeld	–	–
6010	N°6 pezzi di Cenchriti diverse, muniti della loro respettiva provenienza	5072	Calce carbonata globuliforme testacea bruna; di Mohnstein	3498	Calce carbonata globuliforme testacea bruna; di Mohnstein	–	–
5971	E più venti pezzi, ò saggi di Stalattile coralloide e spatosa, variamente ramificati, e contrassegnati per la maggior parte da numeri relativi al catalogo di Delius. Tra questi il più pregiabile è quello che si osserva superficialmente colorito di nero da qualche effluvio metallico, ed un altro pure affatto spatoso, che riposa sopra uno strato di Manganese	5283	Arragonite bianca ramosa trasparente un poco cristallina all'esterni; della Carintia	2820	Arragonite di f. areolare, bianca ramosa trasparente, della Carintia	–	–
5971	E più venti pezzi, ò saggi di Stalattile coralloide e spatosa, variamente ramificati, e contrassegnati per la maggior parte da numeri relativi al catalogo di Delius. Tra questi il più pregiabile è quello che si osserva superficialmente colorito di nero da qualche effluvio metallico, ed un altro pure affatto spatoso, che riposa sopra uno strato di Manganese	5303	Arragonite fibrosa raggiante bianca subopaca nel quarzo	2850	Arragonite fibrosa raggiante bianca subopaca nel quarzo	–	–
522	Miniera d'argento vetrosa plumbea in una Pietra calcaria grigia; di Annaberg nell'Austria	–	–	–	–	–	–
987	Min:^{a} d'Arg:^{o} bianca, tendente al color grigio, combinata con spato calcario ocraceo, e col Quarzo, di Lovy Nobonia nell'Ungheria	–	–	–		–	–
183	Pietra picea porfiritica bruna di fegato venata di rosso, di Planitz	7333	Quarzo resinite porfiritico bruno di fegato e rossiccio; di Triebischstal presso Meissen	928	Opale ferruginosa porfiritica bruna epatica e rossiccia, di Triebischstal, presso Meissen	–	–

(continued from p. 92)

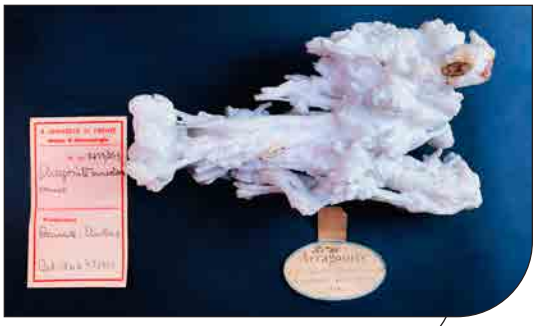

Fig. 3. Aragonite belonging to the Delius Collection. Current Inventory Number G7437, size: 21 x 12 x 8 cm (photo courtesy Firenze University Museum System).

that the specimens, apart from Inv. n. 5315, entered the museum collections in the 18th century. 5 samples (Inv. nos. 2106, 2108, 2109, 2118, 2290) were removed from the mineralogical collections between 1821 and 1842. A closer inspection of table 5 shows that 5 specimens were originally acquired in more than one sample such as Inv. n. 6798 comprising 72 pieces of ferriferous calcium carbonate, whose number decreased over time as the specimens decayed. Inv. nos. 5283 (fig. 3) and 5303 then illustrate 2 out of 20 aragonite specimens (18th-century Inv. n. 5971) that were part of Christoff Traugott Delius's (1728-1779) mineralogical collection, who was a professor at the Bergakademie in Schemnitz (today Banská Štiavnica, Slovakia) and the author of one of the first scholar mining handbook (Delius, 1773; Battek, 2015). The Delius Collection was acquired in 1780 and its original catalog is preserved at the Historical Archive of the Firenze University Museum System (see Archive 15; Benvenuti et al., 2022). Another interesting aspect of table 5 is that two specimens were mounted on potentially valuable items: Inv. nos. 5316 (fig. 4) represents two limestones (nowadays paesina stone) tiles on a golden frame belonging to the Medicean Collection, whilst Inv. n. 5310 describes a limestone on a wooden base edged with gold. What is striking about the data shown in table 5 is that only 9 specimens (Inv. nos. 5135, 5199, 5283, 5293, 5303, 5316–5317, 5332, 7333) are today present in the mineralogical collections kept in the Firenze University Museum System (see Archive 16).

Fig. 4. Calce (nowadays pietra paesina) tile belonging to the Medicean collections. Current Inventory Number M359, size: 15 x 14 x 0.5 cm (photo courtesy Firenze University Museum System).

Concerning the gold and platinum specimens stolen in 1867 (Case #5, tab. 4), they were acquired in the 19th century (see tab. 6). Two specimens came from the Ural (Inv. nos. 5355 and 13164), and two gold samples (Inv. nos. 13164, and 5350) were given to the museum by the prince Anatolij Nikolaevich Demidov (1813-1870) (Tonini, 2013). In this regard, the Royal Secretariat authorized the entry into the museum's collections of a gold specimen from Southern Siberia donated by Prince Demidov on 3 July 1827 (see Archive 17). Due to his many donations (some of which are listed in Cipriani et al., 2011), Demidov received a golden medal from Superintendent Bartolomeo Bartolini Baldelli (1804-1868) on 1 January 1852 (see Archive 18). The other two gold specimens coming from Australia (Inv. nos. 13211 and 13212) were given to the Imperial and Royal Museum of Physics and Natural History by Colonel Maule (dates uncertain), who was awarded a silver medal in late December 1853 (see Archive 19). The last gold specimen involved in the theft that occurred in January 1867 was given to the museum by Giuseppe Del Grande (dates uncertain), who was the executor of Leonardo Ximenes's (1716-1786) will (Barsanti et al., 1987). The robbery that occurred in 1867 was also reported in the catalogs compiled in 1822 (see Archive 20) and 1844 (see Archive 21), but unfortunately, none of the stolen specimens were recovered by law enforcement. In this regard, it is worth mentioning that most of the minerals that were robbed over the years were never found, apart from some specimens stolen on 6 February 1862. In this case, the police reports did not specify their species except for a rosette (i.e., a diamond) that at the time of the investigation was supposed to be in Arezzo (see Archive 22). The rest of the loot was returned to the museum on 3 July 1862 (see Archive 23), following the judicial decision (res judicata) on the conviction of the employee Gustavo Cesari (dates uncertain) and his accomplice Tito Mecci (dates uncertain) to 16 and 8 months of imprisonment for the robbery occurred in February (see Archive 24).

According to these data, it is possible to infer not only some vulnerability factors to which the natural-

istic collections were subjected between the 18th and 19th centuries but also as cataloging was perceived as an effective means to protect museum collections against theft and other threats. In this regard, it is worth mentioning that the first museum inventory was completed in 1777 (see Archive 25) and since then, museum directors have always been responsible for maintaining and updating the catalogs, including the registers listing the specimens that were removed from the collections due to loss or damage. Cataloging was therefore not perceived as one of those tasks that can be put off. Starting from Peter Leopold's motu proprio issued on 21 February 1775 (see Archive 26), it represented a pivotal activity in the museum administration to understand the quantity and quality of the naturalistic collections, where a specimen was located, and what stories it told. This finding is consistent with the events presented in Cases #4 and #5, which showed how the cataloging operations were conducted in tandem with the forensic investigations. Another important finding is that the cataloging of the naturalistic collection was carried out according to standardized procedures such as the identification of an inventory number so that a specimen can be recognized from similar items and the drawing up of a brief catalographic description to account for data about its provenance and history. In the previously mentioned events, the information retrieved by the cataloging activities was transmitted to the local authorities to aid in investigating the theft and in identifying and returning the stolen specimens. This study has therefore shown the worth of having a collection comprehensively cataloged with standardized procedures. Even if the loot was not recovered in many cases, the catalog descriptions provide the only historical record of its existence, thus allowing the reconstruction of the full significance of the naturalistic collections preserved at the Imperial and Royal Museum of Physics and Natural History over time.

CONCLUSIONS

The analysis of the aforementioned criminal cases has evidenced how security represents a critical issue faced by all cultural heritage institutions across time and space. Collections need daily and long-term protection and maintenance as well as immediate emergency response in case they were subjected to thievery and other illegal acts. Alongside the importance to develop proper protection practices and procedures (e.g., vigilance and physical security programs), this study highlighted the importance of cataloging as a pivotal activity in managing museum key assets. Documenting a collection with up-to-date information underpins many museum tasks (e.g., research, exhibition strategies, conservation management) including specimen safeguard planning. As an example, recording the location, provenance, and physical appearance of an item aid in improving its security and retrieval in case of theft.

Inventory Numbers	Catalog 1844
5350	Oro nativo in massa contenente un poco di quarzo nella cavità, di Nynotaguilsk presso Eckaterimbourg della Cava Demidoff
5355	Platino nativo puro in pepite dei terreni d'alluvioni, delle vicinanze di Nynotaguilsk negli Ural
13211	Oro nativo concrezionato col quarzo ialino pingue bianco, della Nuova California (Dono del Sig. Colonnello Monle)
13212	Oro nativo concrezionato col quarzo ialino pingue bianco d'Ophir nella Nuova Galles meridionale (Dono d)
13164	Oro nativo in massa concrezionata dei terreni d'alluvione del bacino della Taguil negli Ural (Dono di S. Ecc: il Principe Anatolio Demidoff)

Tab. 6. Gold specimens as described in the 1844 museum catalog.

In Italy, the cataloging activities are now patronized by the Central Institute for Catalog and Documentation (Istituto Centrale per il Catalogo e la Documentazione, ICCD), which is part of the Ministry of Culture. ICCD has issued 30 national catalographic standards to document, in a comprehensive and systematic way, the different typologies of naturalistic, cultural, and science-technology assets constituting the Italian heritage. The cataloging procedures are managed by the web-based platform SIGECweb (Calosso et al., 2008), and the datasheets are published in Open Access on the General Catalog of Cultural Heritage database (see website 6). The naturalistic heritage can be documented using 6 national standards: BNB (Botanical Heritage; Armiraglio et al., 2007), BNM (Mineralogical Heritage; Casto et al., 2007a), BNP (Paleontological Heritage; Angelelli et al., 2015), BNPE (Petrographic Heritage; Casto et al., 2007b), BNPL (Planetological Heritage; Casto et al., 2007c); and BNZ (Zoological Heritage; Agnelli et al., 2007). In recent years, the standards concerning the cataloging of the geo-mineralogical heritage have been critically reviewed (Franza & Pratesi, 2021b; Franza et al., 2022a). A very effective means to improve museum naturalistic collections protection is to perform cataloging campaigns using the above-mentioned ICCD standards, which gather standardized data about the scientific, cultural, economic, and collecting values constituting a specimen together with information such as its geographical provenance, physical appearance, and conservation status. The results of a detailed cataloging campaign utilizing ICCD standards aid the museums in building a stronger protection program, which represents

one of the primary public purposes of every cultural property institution. Further research should be carried out to establish a new ICCD catalographic paragraph to document thievery, vandalism, security measures, and vulnerability factors to which a museum specimen can be subjected.

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20) The catalog of the mineralogical collections issued in 1822 reported the robbery that occurred in 1867 and the investigations that were undertaken in a text added on the right page corresponding to the description of the stolen specimens.

21) In the catalog of the mineralogical collections issued in 1844, the description of every specimen that was stolen in the robbery of 1867 is followed by the words: "Involato dalla vetrina nel Gennaio 1867 e non rinvenuto alla data del pubblico giudizio della Corte d'Assise di Firenze del 15 novembre 1867".

22) AMG, Carteggio della Direzione, novembre 1861 - dicembre 1862, ARMU Affari 074, aff. 15, c. 18.

23). AMG, Carteggio della Direzione, novembre 1861 - dicembre 1862, ARMU Affari 074, aff. 61, c. 131.

24) AMG, Carteggio della Direzione, novembre 1861 - dicembre 1862, ARMU Affari 074, aff. 56, c. 123.

25) AMG, Catalogo della Direzione, 1771-1794, ARMU Affari 001, c. 191.

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Submitted: June 8th, 2022 - Accepted: September 6th, 2022
Published: December 6th, 2022